

Despite policies directed at improving the health of both the young and the poor, there is little evidence that this relationship has changed. Currie and Schwandt looked specifically at the life expectancy of present-day children and young adults, finding that mortality inequality has in fact declined over the past 25 years (see the Perspective by Bailey and Timpe). — GJC

Science, this issue p. 708;
see also p. 661

IMMUNOLOGY

Notch balances innate lymphoid cells

In the gut, specialized cells either trigger inflammation or induce no immune response. Group 3 innate lymphoid cells (ILC3s), for example, balance tolerance to symbiotic gut microbes with inflammatory responses to invading pathogens. Chea *et al.* found that stimulation of the receptor Notch2 enhanced the production of a subset of ILC3s. Moreover, Viant *et al.* showed that Notch signaling was required to maintain these ILC3s, and its effects were opposed by the cytokine TGF- β . Thus, the proportions of ILC3 subsets depend on the balance between different signals in the gut. — JFF

Sci. Signal. **9**, ra45 and ra46 (2016).

NEONATAL SCREENING

A bile acid assay for timely diagnosis

Niemann-Pick type C (NPC) disease is a fatal neurological disorder caused by the deficiency of an enzyme involved in cholesterol storage. Although this disease was untreatable in the past, new therapeutics are now in clinical trials. The treatments are most likely to be effective if started as early as possible, before neurodegeneration has occurred. Jiang *et al.* identified three bile acids that are greatly increased in the blood of patients with NPC, as compared to healthy controls. One of these bile acids can be reliably measured in dried blood

spots using mass spectrometry. The findings suggest this bile acid test as a possible addition to neonatal screening programs. — YN

Sci. Transl. Med. **8**, 337a63 (2016).

PROTEIN DESIGN

Building new proteins from the old

Proteins are the workhorses of biology. Designing new, stable proteins with functions desirable in biotechnology or biomedicine remains challenging. Jacobs *et al.* developed a computational method called SEWING that designs proteins using pieces of existing structures (see the Perspective by Netzer and Fleishman). The new proteins can contain structural features such as pockets or grooves that are required for function. The solved structures of two designed proteins agreed well with the design models. The method allows rapid design of a diverse set of structures that will facilitate functional design. — VV

Science, this issue p. 687;
see also p. 657

CELL BIOLOGY

Stay on the right track

Cilia contain a well-ordered array of microtubule doublets along their length. A longstanding question in cilium structure and function is why the microtubule arrangement in cilia is so complex. Stepanek and Pigino developed a time-resolved correlative fluorescence and three-dimensional electron microscopy method to show that the doublets provide directionality to intraflagellar transport. One microtubule in the pair moves cargoes up to the ciliary tip. Meanwhile, the other microtubule moves cargoes back to the cell body. These results explain why the axoneme is built out of microtubule doublets and suggest a mechanistic picture of how the logistics of bidirectional intraflagellar transport are regulated. — SMH

Science, this issue p. 721

IN OTHER JOURNALS

Edited by **Sacha Vignieri**
and **Jesse Smith**

Coastal fishes, such as this toadfish, depend on rocky and soft benthic habitats for reproduction and survival.



ECOSYSTEM MANAGEMENT

Underappreciated benthos

The management and monitoring of animal populations is shifting away from a model that focuses purely on abundance, to one that considers the importance of components of the physical and biological environment to a species' persistence. Kritzer *et al.* develop such an ecosystem management-based approach to evaluate a system whose contribution to healthy fish populations is underappreciated. They show that benthic habitats on the east coast of the United States are essential for fish reproduction, with the most valuable benthic forms varying latitudinally. Their analysis showed that some soft sediment habitats were much more important than expected, a notable result given that these habitats have typically been considered expendable. — SNV

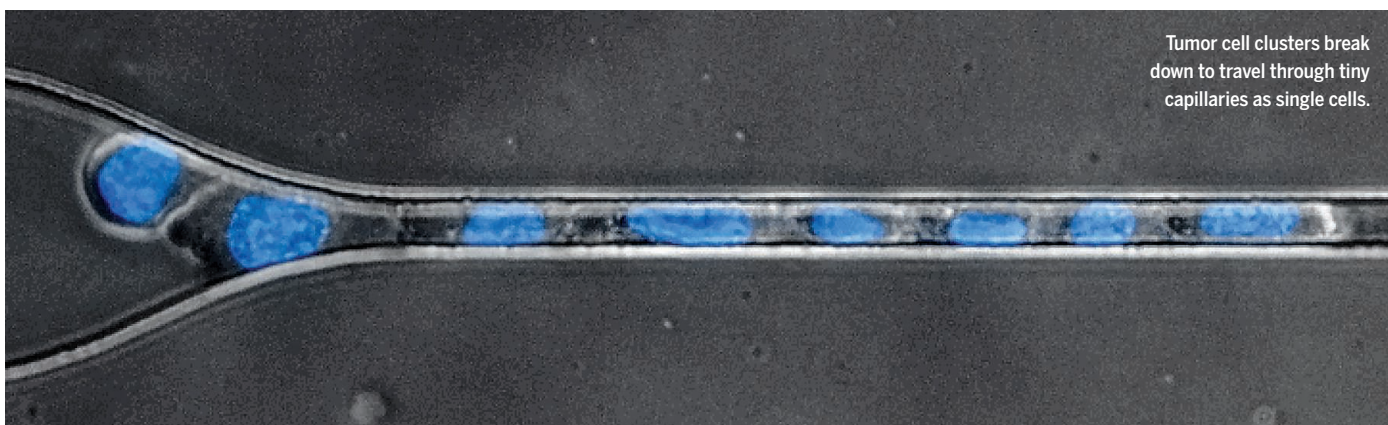
BioScience 10.1093/biosci/biw014 (2016).

DIVERSITY

On-ramp to greater STEM diversity

One path to achieving greater diversity in STEM (science, technology, engineering, and mathematics) fields is through "on-ramping," the process by which women with Ph.D.'s leverage their nonacademic careers and enter academia as faculty members. Three On-Ramps into

Academia workshops were held. Carrigan *et al.* used qualitative methods to analyze the experiences of 10 female Ph.D.'s who attended the workshop and successfully on-ramped into faculty positions. Four phases of on-ramping were identified, including evaluating the value of transferable nonacademic career skills, bridging gaps in experience, coping with both past and present gender



Tumor cell clusters break down to travel through tiny capillaries as single cells.

METASTASIS

Single file through capillaries

Circulating tumor cell clusters (CTCs) are thought to be too large to pass through capillaries, yet such aggregates are found in the circulation, spreading cancer to distant sites. Au *et al.* used a microfluidic device to visualize how they accomplish this. CTCs (of 20 cells or more) isolated from human patient blood unfold into a chain of single cells to pass through microchannels that are the same width as human

capillaries. Once through, the linked cells reformed into a cluster. This behavior was also observed when human CTCs were transplanted into the circulation of transparent zebrafish. Determining how cells of a CTC break and reform their connections may lead to approaches that prevent their transit through capillaries and reduce metastasis. — LDC

Proc. Natl. Acad. Sci. U.S.A., 10.1073/pnas1524448113 (2016).

discrimination, and affirming the value of producing scientific knowledge in academia. Results indicated that on-ramping women have much to bring to a faculty position, including bridging classroom learning to professional scenarios and connecting students to industry and government colleagues. — MM

J. Technol. Transf. 10.1007/s10961-015-9460-5 (2015).

ANTIBIOTIC RESISTANCE

Resistance and sex among bacteria

Gene swapping among bacteria by conjugation (aka sex) has long been thought to be triggered by antibiotics, an effect which then promotes the spread of antibiotic-resistance genes. Lopatkin *et al.* tested a variety of antibiotics on conjugation and found that it is not so simple. Specifically, resistant offspring can be selected, but if the parents are already resistant, resistant offspring are not selected. Alternatively, if parent populations are killed, then less gene swapping occurs. Hence, the direction and efficiency of

conjugation in the presence of antibiotics depends on the dynamics of the whole bacterial population. Models and sequencing can help distinguish and predict rates of gene swapping for particular conditions. — CA

Nat. Microbiol. 10.1038/nmicrobiol.2016.44 (2016).

NEURODEVELOPMENT

Myelination defects in Down syndrome

In Down syndrome (DS), an extra chromosome 21 causes a variety of developmental and cognitive disabilities. Olmos-Serrano *et al.*, have compared the transcriptome of postmortem brains from normal donors as well as those with DS, surveying developmental stages from prenatal to adult. Of over 17,000 genes profiled from two regions of the brain, about 4% revealed abnormal expression. Dysregulated genes, found across the whole genome and throughout the age range, grouped by function. One group of genes affected oligodendrocytes and myelination. Indeed, myelination was deficient in a mouse model of DS, contributing

to defective transmission of neural signals. The authors speculate that poor myelination may underlie the problems with learning, memory, and age-related neurodegeneration that characterize DS. — PJH

Neuron **89**, 1208–1222 (2016).

APPLIED PHYSICS

Mind the (nano)gap

Modern pulsed lasers make it possible to time molecular processes that happen even faster than trillionths of a second. A pump pulse starts off the process, while an investigative probe pulse gets sent on a steadily lengthened detour to delay its arrival by precise increments. Unfortunately, the detour gets impractically long when phenomena last for several nanoseconds. Nakagawa *et al.* introduce a technique to bridge this coverage gap. Rather than setting a detour, they apply a train of probe pulses spanning a wide variety of delays (subnanosecond to millisecond) relative to the pump pulse. The full time frame is then filled in steadily shot by shot. — JSY

Optics Lett. **41**, 1498 (2016).

OPTOMECHANICS

Bouncing to higher sensitivity

Sensors capable of measuring tiny forces have applications in many fields of science and engineering. Such sensors typically exploit the change in the mechanical properties of materials in response to an applied force. Nanofabrication techniques can be used to make extremely sensitive membrane structures, the displacement and vibration of which can be used to sense forces; the highest sensitivity usually requires cooling the structures to cryogenic temperatures. Norte *et al.* and Reinhardt *et al.* now show that the mechanical properties of such membranes can be optimized to sense forces of just several tens of attonewtons (10^{-18} N) at ambient conditions. Their simplified trampoline-like structures, with the membranes suspended at just several connection points, opens up the devices to situations of real-life application. — ISO

Phys. Rev. Lett. **116**, 147202 (2016);

Phys. Rev. X **6**, 021001 (2016).